

## **Arguments/ Remarks**

### **I. Status**

Claim 1 has been amended. Claims 9-19 have been canceled. New claims 20-33 have been added. Accordingly, claims 1-8 and 20-33 are currently pending and under examination.

New claims 20-22 depend from amended claim 1. Support for claims 20-22 is found in the specification at page 4, line 30 through page 5, line 3.

New claims 23-28 are directed to methods of depositing chitosan onto a surface of a microelectronic device. Support for claim 23 is provided in the specification at page 1, line 14 and page 10, lines 30-31. Claims 24-28 depend from claim 23. Support for claims 24-27 is provided in the specification at page 4, line 29 through page 5, line 3. Support for claim 28 is provided in the specification at page 4, lines 20-23.

New claims 29-33 are directed to methods of depositing a chitosan layer onto the surface of a substrate. Support for claim 29 is provided in the specification at page 4, lines 18-20 and page 5, lines 10-12. Support for claims 30-33 is provided in the specification at page 4, line 29 through page 5, line 3.

### **II. The Declaration**

The Examiner has objected to the Declaration as being allegedly defective because the address of inventor William E. Bentley is identified differently in the Declaration compared to information provided in an Application Data Sheet previously submitted.

The Applicants submit that the originally filed declaration of William E. Bentley provides the correct address for Dr. Bentley (909 White Marlin Way, Annapolis, Maryland). The addresses provided in the subsequently filed data sheets were thus in error. The undersigned submits that the errors were inadvertent. An amended Application Data Sheet is being filed with this response correcting this discrepancy.

### III. The Rejection of Claims 1-2 and 6-8

Claims 1-2 and 6-8 were rejected under 35 U.S.C. §102(b) as being allegedly anticipated by, or in the alternative under 35 U.S.C. §103(a) as being allegedly obvious over, U.S. Patent Publication No. 2002/0084194 A1 to Redepenning (“*Redepenning*”).

Independent claim 1 has been amended to recite the additional step of “incorporating a component to the deposited chitosan, the component being selected from the group consisting of a protein, a polynucleotide, and a cell.” Support for this amendment is provided in the specification at page 4, line 29 through page 5, line 3.

*Redepenning* fails to disclose or suggest the incorporation of a protein, a polynucleotide or a cell onto deposited chitosan as now recited in amended claim 1. Rather, *Redepenning* seeks to provide a highly dense composite layer of calcium phosphate and chitosan. See *Redepenning*, page 4, paragraph [0034]. According to *Redepenning*, the calcium phosphate encourages the formation of a bond between living bone and the ceramic material (*Redepenning*, page 1, paragraph [0002]), while the chitosan portion of the composite layer “masks or ‘fills in’ the vacancies and defects in the hydroxyapatite porous, plate-like structure.” See *Redepenning*, page 2, paragraph [0017].

Since *Redepenning* fails to disclose the incorporation of a protein, a polynucleotide, or a cell onto the chitosan portion, it therefore fails to anticipate the invention of claim 1. Further, *Redepenning* fails to suggest such a feature, nor is there any reason to modify the composite layer of *Redepenning* to provide for such a feature. Further, none of the other references remedy the deficiencies of *Redepenning*.

Accordingly, Applicants respectfully submit that the rejection of claim 1 is rendered moot by the amendments herein. Claims 2 and 6-8 depend from claim 1, and therefore are likewise patentable over *Redepenning* and the other art of record for at least those reasons noted above.

In light of Applicants' amendments, it is respectfully submitted that the rejection of claims 1-2 and 6-8 under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) in light of *Redepenning* may now be properly withdrawn.

#### **IV. The Rejection of Claim 3**

Claim 3 was rejected under 35 U.S.C. §103(a) as being allegedly obvious over *Redepenning* in view of Somashekar *et al.*, "Chitosanases – Properties and Applications: A Review," Bioresource Technology (1996) Vol. 55, No. 1, pp. 35=45 ("*Somashekar*").

Claim 3 depends from claim 1, and therefore Applicants respectfully submit that this claim is likewise patentable over the art of record for those reasons noted above. Moreover, *Somashekar* fails to disclose or suggest "incorporating at least one of a protein, a polynucleotide, and a cell onto the deposited chitosan," as now recited in claim 1. Accordingly, Somashekar fails to remedy the deficiencies of *Redepenning*.

It is therefore respectfully submitted that the rejection of claim 3 under 35 U.S.C. §103(a) in light of the combined teachings of *Redepenning* and *Somashekar* may now be properly withdrawn.

#### **V. The Rejection of Claims 4 and 5**

Claims 4 and 5 were rejected under 35 U.S.C. §103(a) as being allegedly obvious over *Redepenning* in view of U.S. Patent Publication No. 2002/0037383 to Spillman, Jr. *et al.* ("*Spillman*").

Claims 4 and 5 likewise depend from claim 1, and are therefore patentable over *Redepenning* for at least those reasons noted above. *Spillman* discloses the use of biocompatible compositions in constructing medical devices, and also discloses generally that such medical devices may be semi-conductor material. *Spillman*, page 5, paragraph [0082]. However, *Spillman* fails to disclose or suggest "incorporating at least one of a protein, a polynucleotide, and a cell onto the deposited chitosan," as recited in claim 1.

Thus, *Spillman* fails to remedy the deficiencies of *Redepenning*. Additionally, *Spillman* teaches “adding multiple layers of oppositely charged materials on top of each other in layer-by-layer fashion.” *Spillman*, page 4, paragraph [0060]. The electrostatic self-assembly (ESA) process disclosed by *Spillman* proceeds as follows:

1) providing a substrate; 2) optionally modifying the substrate to create a surface charge; 3) dipping the substrate into a charged inorganic cluster solution; 4) rinsing the substrate with solution; 5) dipping the substrate into an oppositely charged polymer solution; 6) rinsing the substrate with solution; 7) optionally repeating steps 3) to 6) to yield a multilayer coated substrate. *Spillman*, page 3, paragraph [0052].

The term “clusters” is defined by *Spillman* as “substances that are not molecules, that are not chemically complete substances, and that may vary in size.” *Id.* at paragraph [0053]. Thus, the resulting multilayer structure includes at least a layer of the cluster material as well as a layer of the polymer material.

Although *Spillman* mentions chitosan as a commercially available starting material (see *Spillman*, page 2, paragraph [0039]), it fails to provide any specific examples directed to the use of chitosan. Indeed, the use of chitosan in *Spillman*’s disclosed process is not likely feasible given chitosan is protonated at pHs below a pKa of 6.3 and deprotonated at pHs above the pKa of 6.3. Thus, application of the oppositely charged solution would likely degrade or destroy the initial chitosan layer.

Thus, neither *Redepenning* nor *Spillman*, either alone or in combination, disclose or suggest claims 4 and 5.

It is therefore respectfully submitted that the rejection of claims 4-5 under 35 U.S.C. §103(a) in light of the combined teachings of *Redepenning* and *Spillman* may now be properly withdrawn.

## VI. Concluding Remarks

New claims 23-28 are directed to methods of depositing chitosan onto a surface of a microelectronic device. None of the art of record discloses or suggests depositing chitosan onto a conductive surface of a microelectronic device as recited in claim 23 or its dependent claims.

New claims 29-33 are directed to method of depositing a chitosan layer onto the surface of a substrate, and recites "wherein said layer consists essentially of chitosan." As noted above, *Redepinning* fails to disclose or suggest such a layer, but instead is directed to a composite layer including calcium phosphate:

The calcium phosphate/chitosan containing composite coatings of the present invention typically contain at least about 1% chitosan and more ***preferably at least about 10% chitosan***. The incorporation and intermingling of chitosan in the resulting composite coating on the cathode reduces the amount of surfaces defects found in a neat brushite or hydroxyapatite coating by "filling in" surface voids or defects found in the porous plate-like structure of brushite or hydroxyapatite after conversion from brushite described below. *Redepinning*, page 4, paragraph [0034] (emphasis added).

Thus, the layer disclosed by *Redepinning* does not consist essentially of chitosan. Indeed, eliminating the calcium containing compound would destroy the intent of the invention of *Redepinning*.

*Spillman* likewise fails to disclose or suggest the method of claims 28-31, wherein the resulting layer consists essentially of chitosan. Rather, *Spillman* teaches a multilayer structure of oppositely charged materials, as discussed above. *Spillman*, page 4, paragraph [0060].

Accordingly, reconsideration of the application and allowance of the pending claims is respectfully requested in light of the amendments and remarks herein. Should the Examiner have any remaining questions regarding the subject invention or its patentability, Applicants

encourage the Examiner to contact the undersigned to answer such questions or provide any desired additional information.

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Respectfully Submitted.

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